TITLE

SAFETY DEVICE FOR ELEVATORS

BACKGROUND OF THE INVENTION

The present invention relates generally a safety device for elevators to prevent unintended elevator car movement.

For guiding the elevator car in the case of elevators with guide rails, guide shoes, which are arranged at the elevator car, are employed and such guide shoes are developed either as roller guide shoes or as sliding guide shoes. In the first case, rollers are generally provided with so-called two-dimensional or three-dimensional guides, which roll on appropriate guide surfaces of the guide rail. In the second case, slideway linings slide with small free motion along the guide rails, so that they confer to the elevator car during the vertical transport motion a guide in the horizontal plane. Safety devices, which are physically separate from the guide shoes, are fastened to the elevator car and such safety devices operate to engage the guide rail.

The well-known devices of this kind work in the manner that in case of exceeding the speed limit of the elevator car or respectively in case of over-speed, the safety device is mechanically operated by a speed governor device.

The common safety devices of the state of the art can be categorized according to their construction either to the group of the brake safety devices or the group of the wedge blocking safety devices or the roller blocking safety devices.

A brake safety device is shown in the U.S. Patent No. 6,131,704, which has a slideway for guiding the elevator car along the guide rail. This safety device includes a forked lever mechanism and a relatively large and heavy electromagnet. With this safety device, the guiding apparatus is functionally separated from the braking device or respectively from the safety device. The usage of such a safety device is therefore uneconomical in particular in the case of low cost elevators with small hoisting height, that is to say for buildings with few floors and low hoisting speeds of the elevator car.

In the case of wedge blocking safety devices or roller blocking safety devices, a loose wedge or loose roller is engaged on a side of the guide rail in order to fit between the stationary guide rail on the one hand and an associated abutment of the safety device on the other hand, by means of the speed limiter, while the safety device block is

supported on the opposite side of the guide rail. The prevailing frictional circumstances lead to a further blocking of the clamp body or respectively of the blocking roller and consequently to the braking of the elevator car. Such a blocking roller safety device is described for example in the published European application EP 0 870 719 A1.

Conventional safety devices are applied only in the case of over-speed or in case of inspection work (typically twice per year). Traditional safety devices are in particular of major disadvantage if the elevator car stands at a floor and due to loading, it slips or it falls uncontrolled.

According to the state of the art, an additional so-called creeping protection device prevents the slipping of the elevator car. Thereby, a bolt is pushed into engagement, for example in the appropriate openings of the guide rail, during each stop at a floor, so as to hold in each case the elevator car at the floor level. Further details about the construction and the function of such a creeping protection device are shown in the published European application EP 1 067 084 A1.

A task of the following described invention is therefore to avoid the mentioned disadvantages of the state of the art devices and to create an improved safety device for elevators.

SUMMARY OF THE INVENTION

The safety device according to the present invention has the advantage that it allows, in an excellent manner, an engagement of the safety device in the case of an operating state below the over-speed, that is not so easily possible with the well-known safety devices. Conventional safety devices are never operated in normal operation of the elevator car below the over-speed, which, as a consequence, also makes impossible the early recognition of a possible malfunctioning of the safety device.

A further advantage of the safety device according to the present invention is that it can also be employed as a multifunctional brake device and guiding device for elevators, since it represents a device, which can substitute into one and the same construction three otherwise separated functional units to be employed on an elevator car: these are a guiding device for the elevator car, a safety device and a creeping protection device.

The position of a braking element of the safety device is changeable in a controlled way. Thanks to pre-definition of different positions of the braking element, the safety device can be transferred into different operating states and different functions of the safety device are to be assigned in each case to these different operating states. A mechanism determining the positioning of the braking element allows keeping, in a normal state, the braking element distant from the guide surface of the guide rail. In this normal state, the safety device does not display a braking effect. This normal state of the safety device is adequate for a normal undisturbed drive of the elevator car. The position of the braking element can be changed in a controlled way in such a manner that the braking element touches the guide surface at the guide rail and it is additionally so positioned opposite an abutment that the braking element is not squeezed between the guide surface and the abutment. In this arrangement, the brake is to be arranged in braking readiness, i.e. a state of the readiness for braking. If the safety device is transferred into this state, then a further movement of the elevator car can be possible to a certain extent, since the safety device is not blocked in this state. In the state of braking readiness, an interaction of the braking element with the guide rail is however possible, for example by friction. This interaction between braking element and guide rail makes it possible that the braking element - in a state of braking readiness – is moved in case of a further movement of the elevator car relative to the remaining components of the safety device and opposed to the direction of motion of the elevator car. In case of suitable arrangement of the abutment, the position of the braking element can be changed in such a manner that the braking element comes in addition automatically in contact with the abutment and is squeezed between the guide surface of the guide rail and the abutment. This position of the braking element is called a brake position. In this position, the braking element is blocked and the safety device is arranged in the safety position and in this safety position, a further drive of the elevator car is prevented by the fact that the guide rail is held between the braking element and a retaining element of the safety device.

This safety device can be constructed as a creeping protection device or respectively as a sliding safety device, by transferring the safety device, in case of a stop, into the state of braking readiness. If, under these premises, the elevator car should be additionally loaded, so that the suspension means of the elevator car are stretched and the

elevator car is lowered, then the braking element would be moved relative to the safety device. As described above, the safety device can be brought thereby into the safety position, if the elevator car is lowered at least by a defined minimal distance. In case of a suitable arrangement of the abutment, a slipping of the elevator car can thus be prevented, if the elevator car threatens to drop due to an overload.

In case of this safety device, any reversible controlled transition between the normal condition and the condition of the braking readiness can be realised.

This safety device can also serve as guiding device for the elevator car along the guide rail. The retaining element of the safety device is arranged in such a manner that it acts, in normal state of the safety device, as a guiding device for guiding the elevator car alongside the guide rail. The range of motion in a plane perpendicularly to the direction of motion of the elevator car can be arbitrarily limited by further guiding devices. In this way, a guide for guiding the elevator car alongside the guide rail can be functionally integrated into the safety device thanks to a suitable arrangement of the safety device. Such a guide is usually realised, in conventional elevator systems, independently from a safety device with the help of separated guide shoes. The combination of a safety device and of a guiding device or respectively the integrating of a guide into a safety device is particularly economical and entails a favourable weight saving and space saving. The safety device enables a construction in a particularly compact form. For example, the retaining element, and/or one or more guiding elements, and/or the abutment can be developed as part of the walls of a housing for the safety device. This housing can also be constructed as single piece and offers the basis for a simple modular construction of the safety device according to the present invention.

For the safety device, a constructive simple embodiment results if the braking element is developed as blocking roller. This execution form enables a reliable transition of the safety device from the state of the braking readiness into the safety position. This transition is connected with an rolling motion of the blocking roller, which is simply controllable and which can automatically take place by itself even in case of increasing wear of the retaining element and/or of the blocking roller.

The operating mechanism for the positioning of the braking element can be realized in a simple way with the help of an electromagnet. By a suitable pre-definition of the current flowing through the electromagnet, forces can be varied, and with the

assistance of these forces, the braking element can be brought in each case into the desired position. Such an operating mechanism can be controlled in a simple manner electronically.

DESCRIPTION OF THE DRAWINGS

The above, as well as other advantages of the present invention, will become readily apparent to those skilled in the art from the following detailed description of a preferred embodiment when considered in the light of the accompanying drawings in which:

Fig. 1 is a perspective view of a safety device according to the present invention with a blocking roller as a braking element and an electromagnet for operating the safety gear;

Fig. 2 is another perspective view of the safety device shown in Fig. 1;

Fig. 3 is a front elevation view of the safety device shown in Fig. 1;

Fig. 4 is a bottom plan view of the safety device shown in Fig. 1;

Fig. 5 is a top plan view of the safety device shown in Fig. 1;

Fig. 6 is a view similar to Fig. 3 with the safety device in a normal state, i.e. with the magnet carrying current;

Fig. 7 is a view similar to Fig. 6 with the safety device in readiness for braking with a retaining element without wear;

Fig. 8 is a view similar to Fig. 7 showing wear of the retaining element;

Fig. 9 is a view similar to Fig. 7 with the safety device in readiness for braking with a retaining element without wear, however with an extension of the suspension means of the elevator car;

Fig. 10 is a view similar to Fig. 9 with the safety device in the safety position with a retaining element without wear;

Fig. 11 is a view similar to Fig. 10 showing wear of the retaining element;

Fig. 12 is a schematic representation of an embodiment of the suspension of the blocking roller of the safety device;

Fig. 13 is a schematic representation of a simpler embodiment of the suspension of the blocking roller;

Fig. 14 is a schematic representation of a guide rail with a guide flange in cross section; and

Fig. 15 is a schematic representation of a further embodiment safety device in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 1 shows a base **1**, on which a safety device block **2** and an electromagnet **3** of the safety device are firmly installed. The safety device block **2** has a U-shaped cross section formed by two legs **4** and **5**, whereby the inside of the leg **4** is provided with a guide and brake lining **6**. The safety device is installed on an elevator car (not shown) in an elevator system (not shown) and at the same time is aligned on a guide rail **30** (see Fig. 14), which serves for guiding the elevator car, in such a manner that a guide flange **31** (see Figs. 4 and 14) of the guide rail **30** is arranged between a braking element, which is developed in the present case as a blocking roller **7**, and the guide and brake lining **6**.

In operation, the guide and brake lining **6** touches a guide surface **32** (see Fig. 14) of the guide flange **31**. The leg **4** forms together with the guide and brake lining **6** an oblong retaining element for the guide flange **31**. With the safety device, the elevator car can be held or respectively braked at the guide flange **31**, whereas the guide flange **31** is held between the guide and brake lining **6** and the blocking roller **7**. The other leg **5** is arranged inclined and represents thus an abutment for the blocking roller **7**. So that the elevator car can be braked against a direction of motion, the space between the leg **5** and the lining **6** is narrowed in opposition to the direction of motion in such a manner that the blocking roller **7** can be squeezed between the leg **5** and the guide flange **31**. As clearly shown in Fig. 1, in the present case the space between the leg **5** and the guide and brake lining **6** is upwards reduced. The safety device represented in Fig. 1 is therefore suitable to react against a descent of the elevator car.

A lever mechanism **8** is operated by an operating mechanism including the electromagnet **3**, whereby the lever mechanism **8** is mounted for swivelling around an axle **9**, which is arranged parallel to a longitudinal surface of the guide and brake lining **6** and perpendicularly to the direction of motion of the elevator car. Preferably, a free end of the lever mechanism **8** is coupled with the electromagnet **3**. Thereby, the location of the blocking roller **7** in the mentioned interspace can be changed depending upon the operating state, preferably in that way that the position of an axle **10** of the blocking

roller **7** is changeable along a guide **11** of the lever mechanism **8**, for example via rolling of the axle **10** alongside the guide **11**.

The safety device block **2** is preferably constructed as single piece with the leg **4**, acting as retaining element, and the leg **5**, acting as abutment. The legs **4** and **5** are rigidly connected to the base **2** in such a manner that when blocking further movement of the blocking roller **7**, the leg **4** together with the guide and brake lining **6** is pressed against the guide flange **31**on the side opposite the blocking roller **7**.

The lever mechanism **8** includes for example a part, which serves as a suspension **12** for the blocking roller **7**. This suspension **12** comprises the guide **11**, in which the axle **10** of the blocking roller **7** is moveably placed. The guide **11** can be formed as a groove or respectively as an oblong recess. In order to operate the lever mechanism **8**, the electromagnet **3** exhibits a holding or tie bolt **13** connected with the free end of the lever mechanism **8**, and such holding or tie bolt **13** can be moved in its lengthwise direction relative to the electromagnet **3**, by means of a magnetic field generated with the electromagnet **3**, as indicated in Figs. 1 and 6 by double headed arrows.

In Fig. 2, the base **1** is represented with the safety gear block **2** and the electromagnet **3** in such a manner that a first range with the U-shaped cross section between the two legs **4** and **5** and a second range with an L-shaped cross section as well as a surface structure **14** of the guide and brake lining **6** are clearly visible. In the shown example, the surface structure **14** exhibits an X-shaped applied profile. Over a support **15**, being connected with the base **1** on the side of the leg **5** applied from the blocking roller **7**, those forces that act on the leg **5** when braking can be absorbed by the base **1**.

From the Figs. 3, 4 and 5, a free space **16** is clearly evident and such free space **16** is reserved for the guide flange **31** of the guide rail **30**. In Figs. 4 and 5, a part of the guide flange **31** is shown in section.

As shown in Figs. 1-3 and 6-11, a spring **17** is arranged at the electromagnet **3** and the electromagnet **3** is electrically controllable by means of a release mechanism. In case of a suitable electrical control of the electromagnet **3**, the holding or tie bolt **13** can be moved and the free end of the lever mechanism **8** can be deflected against a restoring force of the spring **17**. At the same time, the lever mechanism **8** is rotated around the axis of rotation **9** around an appropriate bevel and the position of the blocking roller **7** in the interspace between the leg **5** and the guide flange **31** is changed in a controlled way.

In normal operation (driving the elevator car), the electromagnet **3** is current-activated and the holding or tie bolt **13** is held against the spring resistance in an upper extreme position in order to keep the blocking roller **7** distant from the guide flange **31**. In this arrangement, the spring **17** is therefore compressed. If the electromagnet **3** is not current-activated, the holding or tie bolt **13** is arranged under the effect of the spring **17** in a position, which is shifted downwards in such a manner that the blocking roller **7** is brought into contact with the guide flange **31** (Fig. 7). If the blocking roller **7** touches the guide flange **31**, then the premise is created that the safety device achieves a braking action by an interaction with the guide flange **31**. The safety device is then either in the state of braking readiness (braking readiness position), as long as the blocking roller **7** is not squeezed between the guide flange **31** and the leg **5**, or in the safety state wherein the blocking roller **7** is squeezed between the guide flange **31** and the leg **5** in a brake position.

In the case of power failure, just as with an appropriate control of the electromagnet **3**, the safety device is therefore due to the effect of the spring **17** in the braking readiness state or the safety state.

In Fig. 6, the elevator is in the operating state and in such operating state, the elevator runs undisturbed (standard drive) and the safety brake is arranged in the rest position. The electromagnet **3** is current-activated and the lever mechanism **8** is deflected in such a manner that the blocking roller **7** is out of contact with the guide rail **30**. In this position, the axle **10** of the blocking roller **7** rests under effect of the weight on a lowest end or point **27** of the guide **11** of the lever mechanism **8**.

Fig. 7 corresponds to an operating state in which the elevator stands for example at a floor stop, so that no relative motion between the guide rail and the elevator car or respectively the safety device takes place. The current supply to the electromagnet **3** is interrupted, whereupon the lever mechanism **8** is so far swiveled that the blocking roller **7** abuts against a zone or portion **20** of the guide flange **31** of the guide rail. The safety device is in the braking readiness position, and no additional loading of the elevator car took place. The blocking roller of **7** rests unaltered at the lower end **27** of the guide **11**.
Fig. 8 corresponds to the same case, however with a wear of the guide and brake lining **6** of for example 2 mm within a zone or portion **21**. In this case, the bolt **13** is somewhat further extended and the blocking roller **7** approaches thereby nearer to the leg **4**, since

the guide and brake lining **6** became thinner due to wear. The axle **10** of the blocking roller **7** is still placed - as in the case of the Fig. 7 - at the lower end **27** of the guide **11**.

Fig. 9 serves for the explanation of an operating state, in which the elevator stands and the elevator car was loaded and is lowered consequently within the limits of the elastic resilience of the suspension or respectively of the suspension means, whereupon a movement of the safety device occurred relative to the stationary guide flange **31** of the guide rail **30**. During the lowering of the elevator car, the blocking roller **7**, which is already adjacent to the guide rail in accordance with Fig. 7, has been put into an anticlockwise rotation under effect of the friction with the guide rail **30** and is rolled along the guide **11**. The axis of rotation **10** of the blocking roller **7** has taken thereby a new position **22** (in Fig. 9 defined by the lowest point of the axis of rotation **10**), which is shifted opposite to the direction of motion of the elevator car. At the same time, the blocking roller **7** is pushed along closer to the leg **5**, however not yet squeezed between the leg and the guide rail. That the blocking roller **7** has automatically changed its position alongside the guide **11** with the described lowering of the elevator car is a consequence of the superposition of all forces affecting the blocking roller **7**. These forces are in particular:

(i) the friction between the blocking roller **7** and the guide rail **30**;

(ii) the friction between the axle **10** of the blocking roller **7** and the guide **11**;

(iii)the weight of the blocking roller **7**; and

(iv)the force, which is exercised by the guide **11** due to the effect of the forces of the electromagnet **3** and of the spring **17** on the blocking roller **7**.

If the safety device is as described in a condition of braking readiness, then the blocking roller **7** is in a state of equilibrium, which changes only if the elevator car changes its position. The state of equilibrium is characterised by the fact that with a suitable adjustment of the guide **11** relative to the guide rail **30**, an equilibrium of the forces is set in such a manner that only in a case of a lowering of the elevator car and consequently of the safety gear block **2**, the lever mechanism **8** is swivelled relative to the guide rail **30** under effect of the force of the spring **17** (with a lowering of the safety device relative to the guide rail **30**, the spring **17** lengthens in its lengthwise direction) and during this swivelling motion the blocking roller **7** rolls alongside the guide **11** and at the same time realises a movement relative to the safety gear block **2**, this movement

being parallel to the guide rail **30** and opposite the direction of motion of the elevator car. In this way, in the state of braking readiness, the blocking roller **7** takes on a new state of equilibrium after each lowering of the elevator car, and such state of equilibrium exhibits a reduced distance from the leg **5**. Therefore, the blocking roller **7** passes through a series of states of equilibrium when lowering the elevator car, until the blocking roller **7** is finally squeezed between the leg **5** and the guide flange **31** and consequently brought into the brake position. The initial tension of the spring **17** and the form of the guide **11** can be co-ordinated for optimization purposes, in order to reliably control the described change of the position of the blocking roller **7** relative to the guide **11** and to the leg **4** in space and time.

If the elevator car is ready for the continuation of the drive, the electromagnet **3** is current-activated and in this manner the lever mechanism **8** and the blocking roller **7** are moved under effect of the electromagnet **3** and of the gravitational force in such a way that the safety device arrives again into the normal or rest position. The described operating sequence recurs with each "stop". The resilience of the suspension and of the suspension means of the elevator car and the geometrical proportions of the safety device are thereby co-ordinated in such a way that by loading the elevator car beyond the permissible maximum weight, the blocking roller **7** rolls so far alongside the guide **11** that the blocking roller **7** is squeezed between the inclined leg **5** and the guide rail and the safety gear is shifted into the safety or brake position. In this way, the function of a creeping protection device is realised with the safety device.

Fig. 10 shows a state in which the safety device is shifted into the safety or brake position. As a result of a relative motion between the safety device and the guide flange **31** of the guide rail **30**, whose amount exceeds the useful load range described in connection with Fig. 9, the blocking roller **7** moves along the guide **11** up to a position **23** and is now squeezed between the guide rail and the leg **5**. The prevailing frictional proportions in a zone or portion **24** lead to further blocking of the blocking roller **7** in case of a further on appearing relative motion. At the same time, the leg **5** is finally pushed from the blocking roller **7** in a direction (left in Fig. 10) away from the guide rail or respectively the blocking roller **7** is pressed against the guide flange **31**. Fig. 11 shows the state for example in case of a 2 mm wear of the guide and brake lining **6** with a strong

friction in a zone or portion **25**. In the final case, the axle **10** takes an extreme position **26** within the upper range of the guide **11**.

After that the safety device is set into the safety or brake position, the force of the electromagnet **3** is not sufficient any more in order to release the blocking roller **7** from the blocking and to release again the movement of the elevator car, but rather the safety device is to be released in a so-called reversal drive from the safety position, before the elevator car can be moved again downwards.

The leg **4** has a flat surface, as evident from the figures. The guide and brake lining **6** preferably consists of a material, which preferably exhibits a small coefficient of friction during a small surface pressure and a large coefficient of friction during a large surface pressure. Such materials are for example used in multi-plate clutches or brake linings, well known from the automobile industry point of view. The characteristic of the coefficient of friction that the guide and brake lining **6** exhibits as a result a transition zone is as steep as possible between a range with a low coefficient of friction and a range with a very high coefficient of friction. This enables the utilization of the guide and brake lining **6** for the purpose of braking (in case of a large contact pressure) and for the purpose of guiding (in case of a small contact pressure) subject to the size of the contact pressure between the guide and brake lining **6** and the guide flange **31**. In case of a suitable material choice, it is therefore possible to undertake the provided functional combination, according to the present invention, of a brake safety device and a guiding device into a single multi-functional brake in the shape of the present safety device and to optimize independently from each other their employment as a brake device or as a guiding device for the elevator car.

As particularly evident from the Figs. 6 to 12, the guide **11** does not exhibit a straight-lined form for the axle **10** of the roller **7**, but it is provided with a middle portion **28**, in which it makes first a curve to the right and then a curve to the left. This curvature course can be optimized depending upon each employment. The detailed course of the guide **11** between the lower end **27** and the upper extreme position **26** determines in which measure the blocking roller **7** changes its position relative to the leg **5**, if the safety device block **2** is moved around a given measure alongside the guide rail **30**. This change is anyhow non-linear as a function of the path alongside the guide rail **30**, if the guide **11** exhibits a curved course.

A peculiarity, which can be brought back to the special course of the curvature of the guide **11**, is represented in Fig. 12. The curvature of the guide is at the same time exaggeratedly represented for reasons of clarity. The suspension **12** of the lever mechanism **8** is developed in accordance with Fig. 12 in such a manner that, depending on the operating state, the position of the axle **10** of the blocking roller **7** is changed along the guide **11** at two locations in an at least approximately discontinuous manner. The average lengthwise direction of these grooves or oblong recesses forms preferably an angle with the direction of motion of the elevator car. The guide **11** exhibits, because of its curvilinear course, several locations at which the blocking roller **7** can take, due to its form, a stable position - in the following designated as locking position - if the blocking roller were transported alongside the guide of **11** to one of these locking positions as a result of the mechanisms described before. If the blocking roller **7** has arrived alongside the guide **11** at one of these locking positions, then the lever mechanism **8** takes under the effect of the spring **17** a position in which the guide **11** supports the blocking roller **7** in such a way, that the position of the blocking roller **7** is not substantially influenced through small changes in the deflection of the lever mechanism **8** and is therefore stabilized, in particular against the influence of the weight of the blocking roller **7**. The suspension **12** has a lower locking position at the lower end **27** of the guide **11** for the normal operation in the normal state of the safety device in case of current-activated electromagnet **3**, a middle locking position within the middle portion **28** or above the middle portion **28** of the guide **11** for the operation as creeping protection device or respectively for the operation of the safety device in the safety position in each case with a not current-activated electromagnet **3**, and an upper locking position at an extreme position **26'** at the upper end of the guide **11**.

Fig. 13 shows a guide **29**, which can be used as a simplified alternative to the guide **11** in the safety device and which exhibits a linear course. In the example according to Fig. 13, the guide **29** does not exhibit any change of direction. In this case, there is no locking position in the middle portion of the guide **29** for more precisely controlling the position of the blocking roller **7** in case of operation as creeping protection device, in contrast to the example in accordance with Fig. 12.

Fig. 14 shows an example of the simple guide rail **30** with the guide flange **31**, whose thickness is so designed that it fits into the free space **16** (see Figs. 3 and 5). The

guide rail **30** with the guide flange **31** is vertically arranged in the elevator hoistway. Preferably, two guide rails with guide flange are arranged laterally to the elevator car. The elevator car carries in this case two or four safety devices, which stand in interaction with the guide rails. The principle of the present invention is however independent from the thickness or form of this guide flange, provided that at least one guide surface **23** is available.

The momentary position of the electromagnet **3** and, thus, the condition of the safety device is ascertained in the shown example by two switches **18** and **19**, which supervise the position of the holding or tie bolt **13** or respectively the deflection of the lever mechanism **8** and consequently also the operating state of the safety device. The one switch **18** is provided in order to indicate whether the safety device of the elevator installation is in readiness and the other switch **19** (also called "brake - in engagement - switch") is provided in order to indicate whether the safety device is in the safety position. The brake - in engagement - switch is advantageously integrated into the safety circuit of the elevator.

In a further embodiment of the invention, the safety device can exhibit a two-dimensional or even a three-dimensional guide for the elevator car at the safety device block. Such an example is represented in Fig. 15. The safety device, in accordance with Fig. 15, exhibits beside a blocking roller **67**, which is guided alongside the guide **29**, a retaining element **64** with a guide and a brake lining **66** and an abutment **65**. A lever mechanism **68** is available, which is pivoted as indicated by a double arrow **61**. Through the lever mechanism **68**, the blocking roller **67** can be brought into a brake position, and in such brake position, the blocking roller **67** is squeezed between a guide surface **63** of an oblong guide flange **62** installed in the elevator hoistway and the abutment **65**. The safety device comprises an operating mechanism (e.g. an electromagnet, or a mechanical, or pressure controlled mean), which is arranged in such a manner that it acts upon the blocking roller **67** by means of this operating mechanism and lever mechanism **68** in order to change the position of the blocking roller **67** with respect of the oblong guide flange **62**. The safety device is thereby characterised in accordance with Fig. 15 by an additional guiding device **69** that is provided, whose guide surface is provided with a guide lining **70**. The guide lining **70** can be realised in a different way in respect to the guide and brake lining **66**, for example as a wear resistant lining with a small coefficient

of friction. The latter is meaningful since the guiding device **69** has exclusively a guide function and, in contrast to the retaining element **64**, it does not deploy any braking action.

Furthermore, a suitable safety switch (not shown) can be provided, which measures and/or controls the wear of the guide lining and in case of excessive wear, it stops the elevator.

The multi-functional safety device is brought into the state of braking readiness with each stop in the regular driving of the elevator in accordance with the invention, as the current of the electromagnet is switched off. The execution of the safety device allows the lowering of the elevator car in the stopping place in case of loading, without the safety devices getting blocked with the guide rail. By moving the safety devices at each stop, a quasi-automatic checking of the functional efficiency of the multi-functional rail brake takes place.

There are further conceivable embodiments of the invention, which emanate from modifications of the described safety devices. As a braking element also wedges, ellipsoids or other objects can be considered in place of the described blocking roller, if they are squeezable due to their form. Instead of the described lever mechanism, each mechanism can be considered if with this mechanism the position of the braking element can be changed in a controlled manner, in order to guarantee the described functionality of the safety device. The described electromagnet could be replaced by another operating mechanism, which is suitable for changing, via a controlled force effect, the position of the braking element in such a manner that the safety device changes from the normal state into the state of the braking readiness and inversely. Obviously, the described switches **18** and **19** can be replaced also by a sensor, which is suitable to characterize the momentary position of the braking element or respectively their change in order to seize the momentary operating state of the safety device and as the case may be to derive thereon signals for controlling the elevator. The safety device can also be developed for braking for any direction of motion alongside a guide rail. The abutment must be merely aligned according to the respective suitable purpose relative to the guide rail, in order to enable a squeezing of the braking element. Further on, the braking element must be guided accordingly, in order to enable an automatic transition between the normal position of the safety device in the state of the braking readiness and from there in the

respective safety position. In case of suitable guidance of the braking element and a suitable arrangement of the appropriate abutment, a single safety device can be designed on the basis of the present invention for the purpose of braking alongside each of the two directions of motion, which can be realised alongside a guide rail.

In accordance with the provisions of the patent statutes, the present invention has been described in what is considered to represent its preferred embodiment. However, it should be noted that the invention can be practiced otherwise than as specifically illustrated and described without departing from its spirit or scope.